

## Developing Culturally Responsive Teaching through Professional Noticing within Teacher Educator Modelling

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Received: 20<sup>th</sup> February, 2015 / Accepted: 2<sup>nd</sup> June, 2015  
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Ānō me he whare pūngawerewere  
As though it were a spiderweb<sup>i</sup>

Much evidence exists that culturally responsive and equitable teaching practices are challenging to develop. In-the-moment coaching of 'rehearsals' of practice can help foster mathematics teaching strategies, but how such coaching can assist the development of culturally responsive practice is less clear. Drawn from a larger study into rehearsals of practice, this article illustrates how teacher educator modelling of instructional activities with in-the-moment coaching can provide opportunities for professional noticing of culturally responsive teaching practices. Such opportunities were identified across seven videos of rehearsals of practice in which teacher educator pairs modelled and coached mathematics teaching. Examples are discussed in relation to facilitation of professional noticing and two aspects of a framework of 'cultural competencies' for teachers of indigenous Māori learners. Implications include enhanced equity of access to mathematics learning through pre-service teachers being able to notice, discuss, and take part in culturally responsive teaching practices.

**Keywords:** culturally responsive teaching, mathematics education, initial teacher education, indigenous, coaching, professional noticing, rehearsals

We include the opening proverb, ānō me he whare pūngawerewere, to emphasise the complex nature of mathematics teaching and the challenges pre-service teachers can meet in relation to noticing the intricacies of expert teaching. Student teachers (hereafter referred to as STs) often see the fine 'spider web' of teaching, but can miss the specific acts needed to achieve this. There is wide understanding that supporting STs' development of culturally responsive practice is essential but difficult (e.g., Gay, 2013; Hernandez, Morales, & Shroyer, 2013; Sleeter, 2011), in part due to many lacking deep understanding of culturally-linked behaviours, inter-personal communication, and experiences. Further challenges include that important strategies for teaching, such as being able to lead mathematical discussions, are complex and hard to learn (Boerst, Sleep, Ball, & Hyman, 2011). In addition, STs' own mathematics learning experiences



may differ from those advocated within their initial teacher education and they may lack confidence in their mathematical content knowledge (e.g., Maher & Muir, 2013).

STs' development of pedagogical practice can be assisted by helping them to notice, experience, reflect on, and discuss teaching practices in action (Barnhart & van Es, 2015). Building on the work of Grossman, Hammerness, and McDonald (2009), Ghousseini and Herbst (2014) argue that the coordinated use of three pedagogies of teacher education practice – representations (e.g., teacher educator modelling, videos of teaching, and examples of students' work), decomposition of practice (in which aspects of practice are named and discussed), and ST enactment of approximations of practice – is important for assisting them to manage mathematical classroom discussions. The study in this article brings together ideas from the areas of teacher educator modelling and articulation of practice-based decisions (e.g., Ghousseini & Herbst, 2014; Loughran & Berry, 2005) and in-the-moment coaching (e.g., Lampert et al., 2013) by examining how teacher educator modelling of coached rehearsals of practice and associated discussion can contribute to ST noticing of culturally responsive mathematics teaching practices. In our work we position the teacher educator as a more knowledgeable other (Vygotsky, 1978) rather than an expert, and STs as insightful adults whose "repertoire of understanding and ideas" (Lampert & Ball, 1999, p. 36) can be drawn upon to help expose and discuss practice.

In this article, we background the importance of developing ST capabilities in teaching mathematics using culturally responsive practices, and outline challenges to doing so. We then outline the usefulness of professional noticing, rehearsals of practice, and teacher educator modelling for developing STs' teaching and for fostering theory-practice links. Next we explain our use of modelling of coached rehearsals as approximations of practice, carried out within a larger study into ambitious teaching. We describe our study and how modelled rehearsals of practice, with teacher educators taking the roles of presenters and 'coaches', (referred to here as 'modelled rehearsals') provided opportunities for fostering professional noticing of culturally responsive mathematics teaching practices and expanded our understanding of the uses of rehearsals of practice. To do this, we provide and discuss examples from the rehearsals in which deliberate acts of teaching, consistent with culturally responsive practices, were or could have been exposed and discussed. We conclude by discussing implications of this work for further research and practice.

## Culturally responsive teaching

Teaching in ways responsive to the cultures of our students is vital to enhance equity of access to achievement (Banks & Banks, 2010; Gay, 2010; Macfarlane, 2004; Villegas & Lucas, 2002) and putting education policy (e.g., Ministry of Education, 2011, 2013) into practice. However, developing culturally responsive teaching and adopting culturally linked competencies has proven to be challenging for teachers internationally (Castagno & Brayboy, 2008; Turner et al., 2012) as well as for New Zealand teachers (Alton-Lee, 2003; Bishop, 2012; Bishop, Berryman, Tiakiwai, & Richardson, 2003; Education Review Office, 2002; Hynds et al., 2013). In particular, challenges arise for those teachers who lack knowledge of the cultures of their students and who have not experienced culturally responsive practices in their own formal learning experiences or, if they have, have not noticed them or identified how they can be integrated within mathematics instruction (Jorgensen, Grootenboer, Niesche, & Lerman, 2010). Assisting STs to develop cultural competencies within initial mathematics teacher education is therefore



particularly important for enhancing equity of access to achievement, given that the support in schools for ST and beginning teachers' development of culturally responsive teaching may be limited.

In the New Zealand context, although progress towards equitable school learning opportunities for indigenous Māori has been made, this group of students continues to be underserved in comparison to their New Zealand European counterparts (Ministry of Education, 2010). Consistent with culturally responsive and indigenous strategies in the international literature (e.g., Banks & Banks, 2010; Castagno & Brayboy, 2008; Gay, 2010; Villegas & Lucas, 2002), and aimed at enhancing indigenous Māori student achievement, five "cultural competencies" for teachers of Māori students are promoted within New Zealand education policy:

Wānanga: participating with learners and communities in robust dialogue for the benefit of Māori learners' achievement.

Whanaungatanga: actively engaging in respectful working relationships with Māori learners, parents and whanau [extended family], hapu [subtribe], iwi [tribe] and the Māori community.

Manakitanga: showing integrity, sincerity and respect towards Māori beliefs, language and culture.

Tangata Whenuatanga: affirming Māori learners as Māori. Providing contexts for learning where the language, identity and culture of Māori learners and their whānau is affirmed.

Ako: taking responsibility for their own learning and that of Māori learners. (Ministry of Education, 2011, p. 4)

The competencies are designed to help achieve the government's intention that Māori students achieve educational success as Māori (Averill et al., 2014; Ministry of Education, 2008, 2013) within the "context of the vibrant contemporary Māori values and norms, reflecting the cultural milieu in which Māori students live" (Ministry of Education, 2011, p. 3). Each competency is described using "behavioural indicators" for teachers and school leaders that can enable the education system to "work better for Māori" (Ministry of Education, 2011, p. 3) and examples of learner and whānau (extended family) voice that would indicate that such competencies are in place. The document holds that excellent relationships and engagement between teachers, Māori students, whānau, iwi (tribe), and wider communities are vital for teaching and learning.

Collectively, the cultural competencies are promoted towards teachers "knowing, respecting, and working with Māori learners and their whānau and iwi so their worldview, aspirations, and knowledge are an integral part of teaching and learning" (p. 4). While the competencies are not recognised as formal graduating standards for teacher education, they are, however, consistent with and linked to the New Zealand *Graduating Teacher Standards* (New Zealand Teachers Council, n.d.a) and *Registered Teacher Criteria* (New Zealand Teachers Council, n.d.b). In this article we focus on two competencies, 'wānanga' and 'ako' (described below) that we consider to be most closely related to ambitious mathematics teaching practices such as developing mathematical thinking and managing mathematical discussions, and the processes inherent in modelling and decomposition of practice.

The competency wānanga involves teachers in a range of inclusive practices, such as co-construction of learning, effective learning and teaching practices, communication with students, whānau, and iwi, and enabling students, whānau, and iwi to engage in discussion and debate. The graduating teacher 'behavioural indicators' for this competency include "knowing

how to support effective teaching interactions, co-construction and co-operative learner-focussed activities" (p. 9) and being able to explain the application and use of wānanga in a classroom context. 'Learner outcomes' for this competency include students experiencing the teacher talking with them about their learning, listening to them and caring about what they think, and discussing learning progress with them, their parents and whānau.

Ako is commonly understood in New Zealand to describe teaching and learning and the reciprocity between them. This cultural competency involves teachers ensuring that the classroom curriculum and pedagogical approaches used are effective for Māori learners and that learning and teaching happen in reciprocal ways (with students, parents, and whānau) in and beyond the classroom. The graduating teacher 'behavioural indicators' for this competency include teachers being committed to high expectations of Māori learners achieving as Māori, having a wide range of strategies for ensuring successful learning for all Māori learners, and understanding that Māori learners' identity, experiences, and culture underpin their prior knowledge. 'Learner outcomes' for this competency include students knowing that their teacher does not give up on their learning, knows how to help them learn, provides clear feedback on learning, and that their teacher enjoys learning from them.

Understanding of the terms wānanga and ako is assisted by deep Māori cultural knowledge and understanding. For example, simple translations of wānanga include that the term is used as both a verb and noun, including meanings such as to discuss, debate, consider, important traditional cultural, religious, historical, genealogical and philosophical knowledge, and instructor, wise person, sage, authority (Moorfield, 2015). Definitions of ako include to learn, study, instruct, teach, and advise (Moorfield, 2015). For policy (Ministry of Education, 2011) to be fully implemented, teachers and their learning communities would need deep cultural understandings of the competencies and the cultural practices and contexts within which they are traditionally practised. The majority of New Zealand teachers are New Zealand European and such understandings are not yet widespread. Hence, examples of how the competencies can be enacted within teaching and learning are needed to help implement policy and develop understanding of culturally responsive mathematics teaching, and through these, to enhance equity of access to achievement for Māori learners. In our study we wanted to explore how we could ensure that our STs experienced wānanga and ako within mathematics teaching and learning and how they could be helped to notice and discuss enactment of these competencies.

### Initial teacher education, professional noticing, and modelling

Teacher knowledge and practice are complex and multifaceted (Adoniou, 2014; Shulman, 1987). To help consider aspects of pedagogical practice, teaching can be thought of as taking place across a series of moments. During each moment, the teacher makes decisions about how the lesson will progress, regarding for example, what to respond to or whether to give a further example or a different explanation. Many such decisions need to be "made on the fly with incomplete, even erroneous information" (Mason, 2002, p. 27). Mason discusses the *discipline of noticing* as experiencing and exploiting moments of full attention so that they can be re-entered, reconsidered, and used to inform future practice. Noticing is not necessarily deliberate or conscious, but with practice can be undertaken intentionally. Termed *professional noticing* (Mason, 2002), experienced teachers routinely notice aspects of their own or observed lessons that they reflect on or discuss with others.



Initial teacher education frequently values easily assessed aspects of practice such as lesson plans and evaluations. However, learning what is important to attend to and how to respond is part of developing professional expertise (Jacobs, Lamb, & Philipp, 2010). Learning to discern, analyse, and respond to student thinking and learning among the multiple interactions that occur in classrooms is pivotal in becoming an effective teacher (Barnhart & van Es, 2015) and is particularly important for developing ambitious mathematics teaching. Learning to teach mathematics in culturally responsive ways involves developing behaviours exhibited by expert teachers including minute-by-minute noticing, decision making, and adapting. Such behaviours are difficult to articulate in the moment and are largely invisible to STs in classrooms (Ainley & Luntley, 2005). Hence, assisting STs to notice significant mathematical and pedagogical moments is important for developing culturally responsive ambitious mathematics teaching practice.

Experienced primary teachers showed development of professional noticing when provided with repeated opportunities to observe and discuss their own and others' practice in a community of learners (Davies & Walker, 2005). Structured focussed discussion while observing videos of teaching has also been found to impact positively on teachers' practice (Sherin & van Es, 2009). However, STs have a limited experience of teaching and are hence less likely to be able to identify critical moments during a lesson, or if such instances are identified, they are less likely than experienced teachers to identify a suitable teaching response (e.g., Stockero & Van Zoest, 2013). STs tend to focus on superficial details that do not accurately reflect student thinking and learning, such as students' on-task behaviour and enthusiastic raising of hands (Erikson, 2011). With structure and practice they are able to develop more sophisticated levels of attention to student thinking, although this does not necessarily go hand in hand with developing more sophisticated analyses of or responses to this thinking (Barnhart & van Es, 2015; Jacobs et al., 2010). STs' experiences of teaching alone do not necessarily develop the components of professional noticing; structured and sustained opportunities appear important in the development of noticing skills for teaching (Jacobs et al., 2010).

The use of coaching towards enhancing teacher practice has attracted increasing attention in recent years (e.g., Joa, 2013; Vogt & Rogalla, 2009). Theory and practice in mathematics teacher education has been interwoven through in-the-moment coaching of ST rehearsals of teaching, effective for developing their abilities to promote mathematical thinking and discussion (e.g., Lampert et al., 2013). A rehearsal is "a social setting for building novices' commitment to teaching ambitiously" (Lampert et al., 2013, p. 227). Rehearsals can "involve novices in publicly and deliberately practicing how to teach rigorous content to particular students using particular instructional activities" (p. 227), with a teacher educator using the performance to guide the "collaborative examination of appropriate teaching actions" (p. 227). However, in curriculum-heavy teacher education programmes, such rehearsals with coaching can be time-consuming and it can be challenging to provide individual coaching for all. In our own context, time constraints mean that we are unable to coach every ST enacting practice. We have also found that the effectiveness of public rehearsals can be undermined by strained classroom relationships and lack of ST confidence in their mathematical content knowledge.

Representations of practice (teacher educator modelling) also enable interweaving of theory and practice to reinforce and strengthen key ideas, "unpacking the problematic nature of teaching for student-teachers" (Loughran & Berry, 2005, p. 202). Communication about "practice, practical tips, theory, and contextualisation" within modelling is important in teacher education programmes (Wasserman & Ham, 2013, p. 90), with STs seeing their teacher educators' modelling of practice as very influential on their teaching: "witnessing them teach



their classes ... made a huge difference" (p. 83). Moving beyond telling, showing, and guiding practice, explicit teacher educator modelling is valuable for ST articulation of the thoughts and actions involved in pedagogical decision making (Loughran & Berry, 2005).

Next we describe our exploration of using modelled rehearsals of practice. We argue that such modelling can support professional noticing and pedagogical discussions, while making opportunities for discussion of specific practices that support culturally responsive mathematics teaching.

### Modelled rehearsals of practice

As part of a joint practice-based research study undertaken with colleagues at another institution (Anthony et al., 2015), our team explored the use of in-the-moment coaching of STs in rehearsals of practice. We used rehearsals, involving the enactment of specific instructional activities (e.g., choral count, quick images, and strings), to bring to the fore explicit noticing of acts of ambitious teaching in relation to promoting mathematical thinking and orchestrating mathematical discussion (e.g., Chapin & O'Connor, 2007; Stein, Engle, Smith, & Hughes, 2008). Through the project we aimed to improve the STs' abilities to respond in-the-moment while teaching by helping them to notice, consider, and discuss a range of pedagogical practices in relation to course theory and experiences.

As no other courses in our STs' programmes were using such rehearsals, we used modelled rehearsals to illustrate how in-the-moment coaching would be incorporated within the ST-led rehearsals of practice. To illustrate the rehearsal and coaching process, one teacher educator introduced an instructional activity through enacting it (presenter), and another took the role of coach. The instructional activities used included mathematical content and pedagogical approaches suitable for STs' own teaching. Professional noticing was scaffolded using 'pauses' in the rehearsal to question the presenter or the class or to remark on significant events. For example, the coach may pause a rehearsal to ask questions such as "What is the presenter doing now?" "Why do you think she is doing that?"

Although we had not deliberately incorporated culturally responsive practices into the modelled rehearsals, our informal reflections on these included that practices consistent with culturally responsive teaching, in particular with wānanga and ako, were present both in the teaching strategies used by the presenters and in the process of interaction within the pauses. We surmised that such instances provided opportunities for decomposition of practice to develop STs' professional noticing, and through this, their own use of culturally responsive teaching. Hence, we examined the coaching interchanges in the modelled rehearsals for opportunities for discussion of these two cultural competencies. Teacher educator modelling, rather than other representations of practice (such as videos or student work samples), was chosen in order to maximise the relevance of the learning for each group being taught. In this article we demonstrate how teacher educator modelling of teaching with coaching can provide opportunities for STs to notice and discuss the enactment of these cultural competencies and deliberate acts of ambitious mathematics teaching.

## The Study

Videos of modelled rehearsals were collected over three years. Coaching of ST-led rehearsals was not included in order to maintain focus on the noticing of expert teaching practice. Participants included four experienced New Zealand European teacher educators, two male and two female, and seven classes from a range of initial elementary and secondary school mathematics teacher education courses. The STs were predominantly New Zealand European, with others of indigenous Māori, Pacific Nations, and Asian ethnicities. Full ethical approval was gained for the study.

All coaching exchanges in the seven modelled rehearsal videos were identified and then collaboratively analysed by the research team. The mathematical content and pedagogical focus of each exchange was recorded. To develop a shared understanding across the research team to inform analysis in relation to *wānanga* and *ako*, two research team members independently identified key aspects of *wānanga* and *ako* drawing from *Tātaiako* (Ministry of Education, 2011) and these were then contrasted, discussed, and combined. Examples identified for *wānanga* included opportunities for STs to learn how to support effective teaching interactions through managing co-construction, and using cooperative learner-focussed activities. Ways of creating opportunities for students to have their teacher talking with them about their learning, listening to their ideas, and caring for and discussing their learning progress were also identified as examples of this cultural competency in action.

For *ako*, aspects identified as relevant included instances of reciprocity of teaching and learning in which students were sharing responsibility for their own and others' learning. Commitment to high expectations of student learning, use of a range of culturally responsive teaching strategies, and demonstrating understanding that learners' experiences, identity, and culture underpin their prior knowledge were also sought as examples of opportunities to highlight *ako* in practice. In addition, instances when learners could be expected to believe that their teacher was not giving up on their learning, knew how to help them learn, provided clear feedback on learning, and enjoyed learning from them were identified as aspects of *ako*.

To examine opportunities in the videos for noticing and discussion of *wānanga*, each pause was analysed in relation to who had initiated the pause (coach, presenter, ST), and the result of the pause; who responded, whether there was a single response or more than one person responding, and the nature of the interactions during the pause (i.e., question and answer or discussion) were noted. These were used to examine the extent to which robust dialogue, co-construction, discussion, and debate were present. To examine the video pauses in relation to *ako*, instances in which the presenter showed they were committed to high expectations of learning, provided clear feedback, learnt from the students, showed themselves to be a learner, and demonstrated that a range of strategies were useful for promoting learning were noted.

Aspects of *wānanga* and *ako* as described by the Ministry of Education (2011) we felt unable to be identified and discussed in relation to the modelled rehearsals included relating to communication with whānau, hapu, iwi, and the Māori community, and specific acts in relation to Māori learners. However, we believe that developing noticing and discussion of the practices above enables development of the skills and strategies advocated in policy and may be transferable to contexts which include these groups.

## Results

We start with an overview of coaching interactions that encouraged professional noticing and discussion of pedagogical practices drawn from across the modelling sessions. Next, to illustrate how pedagogical discussions were initiated by coaches, we provide examples of questions and statements made by coaches and presenters when they paused the instruction. We highlight examples of professional noticing and pedagogical discussions from the videos and discuss how particular examples show consistencies with the cultural competencies wānanga and ako.

All seven modelled rehearsals included multiple examples of the coach pausing the rehearsal to expose and facilitate professional noticing of practice, for example, by asking questions of the STs:

- Why do you think Michael has asked you to think for yourself about this?
- What do you notice about the way Roger is recording responses on the board?

Statements or questions were also made by the coach to the presenter to scaffold ST professional noticing:

- I noticed you were telling James [the learner] what he thought. I'm just wondering if there is another way you could have interacted with James?
- Michael, can you tell me why you have suddenly moved?
- Dayle, why did you choose to use pairs now?
- Roger, how could you structure the activity to encourage the use of more mathematical terms?
- The discussion is going teacher, student, teacher, student, teacher, student... as opposed to a discussion around the class, which is why I paused.

All sessions also included pauses designed to generate discussion about effective pedagogies. For example, questions directed to STs to elicit discussion about alternative pedagogical practices included:

- What could Dayle do to engage those two students? (asked by 'coach')
- What can I do if I really wanted an answer to emerge that was not given? (asked by presenter)
- What strategies could Michael have used to get more people involved in the discussion? Discuss this in pairs and then we will feedback together. (asked by 'coach')

Coaching using questions such as these enabled STs to experience practice consistent with culturally responsive teaching. For example, wānanga is evident through questioning in which co-construction of understanding about effective pedagogy was expected. Aspects of wānanga are also evident in the coach demonstrating how STs could have their teacher talking with them about their learning and listening to their ideas. Elements of ako are present in that the coach is demonstrating high expectations of STs' input and shows they know how to develop learning. Examples of how wānanga and ako were demonstrated in the modelled rehearsals (e.g., through enabling co-construction and sharing of ideas) follow. The first illustrates how professional noticing and discussion of pedagogical decision making in relation to a course reading (Stein et al., 2008) was enabled in a rehearsal, illustrating theory-practice links. We then

discuss opportunities for decomposition in relation to culturally responsive teaching using examples from the modelled rehearsals.

*Professional noticing and discussion of mathematical pedagogical decision making*

The following extracts are from a modelled rehearsal in which the teacher educator presenter (Michael) is demonstrating using recording of a choral count beginning at 68 and counting down in 3s on the whiteboard to generate mathematical talk about number patterns and generalisation (Figure 1).

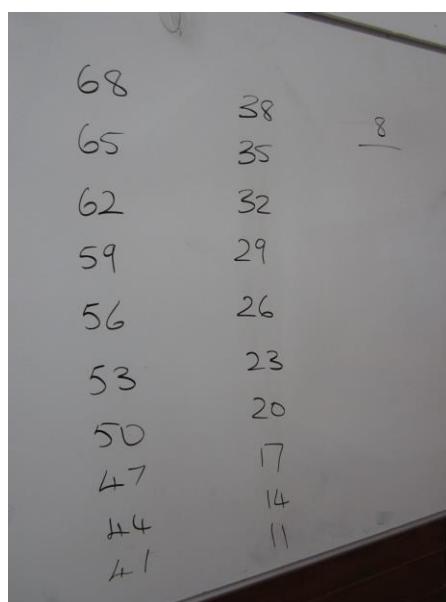


Figure 1. Board work showing choral count.

The first extract illustrates how ideas for enabling mathematical thinking were gathered from STs through a coaching exchange designed to help them notice and discuss practice:

Presenter: 41...

Chorus: 41, 38, 35, 32, 29, 26, 23, 20, 17, 14, 11, 8,

Presenter: And we will stop there. What I want you to do now is think to yourself, we have a whole lot of numbers on the board, but I want you to think about the patterns you see within those, what patterns can you find? Just to yourself.

Coach: Pause. Why do you think Michael has asked you to think for yourself? There are lots of ways he could have asked that question about what you are seeing there, he could have asked for hands up or he could have asked

and waited for people to call out. Why do you think he has asked you to all think to yourselves?

*Student 1: Not to give it away for other people.*

*Student 2: Different people take a different amount of time to realise and he might want to give them more time.*

*Student 3: Let's everyone think about it in their own way.*

Presenter: That was actually my purpose. I wanted everybody thinking about patterns, not one or two people and half the class looking out of the window because you don't know what is coming next. So, by giving you that option of thinking for a moment to yourself, I reinforce that.

In the example above, STs were quick to offer pedagogical ideas. What happened next in the rehearsal shows the coach acknowledging their responses to the next coaching question, and providing a further idea for them to consider.

Presenter: Once you have written down your patterns, start talking to the person next to you about the patterns you have seen.

Coach: Pause. So why do you think it is that Michael is getting you talking in pairs? Again there are lots of things that he could have done; he could have gone on and got you counting more or looking at more patterns or asked one person to report back. Why do you think he chose to get you talking in pairs?

*Student 1: A break from listening, shifting it from listening to discussing.*

Coach: A shift in style, yes.

*Student 2: Often you are more open to sharing your ideas with small groups rather than sharing them with the whole class.*

Coach: Yes, absolutely.

*Student 3: If there is someone at your table who has noticed something different, it is an opportunity for peer teaching.*

Coach: And practising – along with both those last answers is practising talking about the pattern before you are on the spot in front of the whole class ... There is another reason as well; how many people were talking? Everyone? Whereas if Michael had called for one answer, there is one person talking ... By doing that think, pair, share, which this is, in action, you are enabling all of the students in the class to practise the mathematical talk.

Despite the STs having earlier read and discussed Stein et al.'s (2008) article on practices for orchestrating mathematical discussion, they did not suggest that the think, pair, share time might provide the teacher with the opportunity to gather information about individuals'/pairs' thinking as part of potential sequencing of responses. Later in the rehearsal the coach takes an opportunity to explore the value of such sequencing, this time the teacher educators (coach and presenter) explain the instructional decision making:

Presenter: Now I want you to write down some of those patterns you saw because in a minute you are going to be turning to each other and talking to each



other about the patterns you have seen. So write down some of the patterns you have seen or thought of.

(Presenter is walking around the class looking at what students are writing.)

Coach: Pause: And what's Michael doing now?

Student 1: Making sure we are on task.

Coach: And?

Student 2: Observing.

Coach: Observing what? (long pause) He will be looking to see what kind of patterns each person is spotting. When the teacher is moving round the class, hopefully they are being strategic and not just using proximity to make sure learners are on task but seeing: Is there writing going on? Has everybody found the same pattern? What kinds of patterns are people recording? And storing away that information for informing their next teaching decisions.

Presenter: And I could not do that unless I told you to write it down. So telling you to write [it] down gives me an option to see the thinking that has been going on.

Aware that the STs were not immediately seeing or able to discuss how specific aspects of practice in the rehearsal linked to their course reading, the coach and presenter were able to initiate discussion and comment to assist ST noticing.

Opportunities for discussion about the cultural competencies in action were found in all of the modelled rehearsals. Six of the seven rehearsals were determined to include examples consistent with *ako* and six with *wānanga*. Examples of each are discussed next.

### *Wānanga – opportunities for helping student teachers notice effective teaching interactions and co-construction*

A range of inclusive practices are demonstrated in the next examples from the rehearsals, helping show how expectations that all can contribute mathematically can be put into practice. Aspects of *wānanga* are evident, both in the way in which the instructional activities are used, and in the discussions about pedagogical practice. In the first example, the presenter (Roger) encouraged co-construction of mathematical ideas by fostering mathematical learner talk, listening, and discussion in his use of the instructional activity. Co-construction is also evident in the pedagogical discussion for assisting professional noticing created by the questions and comments made by the coach and presenter.

Roger demonstrated teaching algebraic and number patterns using a 'string' activity, an instructional activity in which a series of connected questions are asked and recorded to focus student thinking and talk on specific strategies or number properties. With this string, Roger's focus was on using mathematical properties rather than algorithms to solve multiplication problems. The first question given in the string was:

$$4 \times 25$$

Roger asked STs to work out the answer and talk with their partner about how they worked it out. Karen was then asked to share her answer and her method (instant recall):

$$4 \times 25 = 100$$



With the first question left on the board, the second question in the string was provided:

$$4 \times 25 = 100$$

$$12 \times 25$$

The STs were asked to use their previous answer (100) to help them work out the answer to the new question, to discuss in pairs, and again to volunteer to share their answer and reasoning with the class. Ella shared her thinking and answer after which Roger asked the class to tell their partner what they had heard Ella say. The third problem in the string was then given:

$$4 \times 25 = 100$$

$$12 \times 25 = 300$$

$$13 \times 25$$

Again, STs solved the new question then discussed their methods in pairs. They were asked to share with the class how their partner had solved the question, then the fourth question in the string was posed:

$$4 \times 25 = 100$$

$$12 \times 25 = 300$$

$$13 \times 25 = 325$$

$$6 \times 75 =$$

To foster professional noticing of pedagogical practice, the coach then led a discussion by directing questions to the students. In this excerpt we see an ST identifying the deliberate acts of teaching that enabled discussion and co-construction:

Coach: So, what strategies did Roger use to get you thinking mathematically and listening and talking mathematically? A lot of the time you were sharing ideas. So how did he do that, because that's what we want you to do in the activities you will be teaching?

Student: *We shared our own ideas. Also at one point he asked us to share our partner's ideas to make sure we actually listened and understood, and we also discussed someone else's idea, just to reinforce...*

Coach: So he was quite directive? – so with an idea that he liked he asked you all to be able to revoice that person's idea. He got you revoicing one another's ideas in two ways – everyone revoicing Ella's idea and you revoicing each other's ideas in your pairs. Yes, absolutely. So please try to use those strategies when you are working today whether you are using a string, a choral count, or a quick image.

STs were also encouraged to notice mathematical aspects of the activities. Here we see how the presenter revoiced and elaborated on a student's comment about the mathematics in the string activity to help them understand a common problem solving strategy:

Presenter: I heard Karen say 'but often you don't have two nice lead-in problems before you confront a hard question.' I agree with that. Here is a way that you can use to do some preparatory work to solving a hard problem – using some lead-in problems in our heads so we can broaden our ways of thinking mathematically. If we have a rich repertoire of ways that are reasonably efficient and still make sense ... To finish up I just want to emphasise that the strategy I wanted you to be thinking about was the problem solving strategy of solving a simpler problem, a very, very useful problem solving technique. If I can solve a simpler problem, I can then use what I've found from that to help solve the harder one.



Wānanga was evident in many of the rehearsals when the discussion involved many people in the classroom, showing STs were confident and comfortable to share their ideas, and realised that more than one answer is suitable and relevant:

Coach: Pause. Is there a way to increase the proportion of learner talk? Talk in pairs about how to adapt what Michael has done to increase the amount of learner talk.

Student 1: Asking others for similar ideas.

Student 2: Pairs then giving specific maths terms and asking them to discuss again in pairs using the terms

Student 3: Other ideas - students making up their own example for everyone to do next.

Wānanga was also evident in rehearsals in which pauses were initiated by the presenter and the STs as well as the coach. For example, in one modelling session, the presenter called a pause to highlight a deliberate act of teaching by drawing attention to his recording method:

What is going on with what's happening on the board at the moment? All the important bits [of teaching] can slip under the radar.

No responses were received, and so the presenter went on to explain how he had used colour and board layout to help learners to see algebraic and geometric patterns and to make links between explanations. Later in the same rehearsal the coach asked for a pause, first clarifying that the presenter was purposeful in his selection of those reporting back to the class, then questioning the STs about possible rationale, in order to highlight aspects of one of the course readings (Stein et al., 2008) in practice:

Coach (to the presenter): Was there any reason why you asked Lauren first and then Emma?

Presenter: Yes

Coach (to the students): Can you talk in your groups about why the presenter made these strategic decisions about presenter order?

The group-based discussion was followed by the presenter leading the class discussion:

Presenter: Who can suggest what I was trying to do?

Student: Start with imaging?

Presenter: Um, no...

STs then shared further ideas before the presenter confirmed his rationale, highlighting consistencies and differences between their ideas, his rationale, and the course reading.

This sequence of pauses and discussion is an example of wānanga in action, as there is a clear focus on supporting effective teaching interactions through co-construction and cooperative learner-focussed activities. Learners experienced their teacher talking with them about their learning, listening to their ideas, and showing care for their learning progress through making clear opportunities for thinking and discussion and through making clear links to course materials. STs were involved in these practices through participating in both the instructional activity and the decomposition of practice enabled by the coaching pauses. We believe that STs could have been enabled to notice practices consistent with wānanga through instances such as those described above. For example, teacher educators could have, either during or after the rehearsal, asked STs about how they had been participating in co-construction, how they had seen the presenter showing care for and nurturing their learning progress, and how the presenter had supported effective discussion. From this, STs could be helped to consider how they could implement these practices in their own teaching, in particular for Māori learners, and how aspects such as co-construction can be used more widely in school settings, for example, when engaging with whānau.



### *Ako – opportunities for helping student teachers notice reciprocity of teaching and learning*

The next example illustrates the presenter being a learner by using trial and error and restarting the instructional activity. STs are able to hear and discuss the presenter's rationale regarding why he felt the activity was not working as intended, then experience the activity again, this time presented in a different (and more successful) way. Through knowing their teacher was not giving up on their learning, and learning in a positive classroom environment with relaxed laughter, and a presenter enjoying working with them (as evident in the video), STs were experiencing one aspect of *ako* in action.

The 'string' activity used in the rehearsal started with 20 litres of juice being put into 4 litre containers. Students were asked to decide what type of operation was needed to solve the problem, to discuss this in their groups, and then to share their thinking with the class. After some sharing of students' mathematical ideas, the presenter paused:

Presenter: One of my problems at the moment with my string is that there is some mathematics going on here that is problematic for me running the string activity and that is the whole business about whether this is a sharing problem or a repeated subtraction problem, and I was hoping that once I got a few more things up on the board I might be able to clarify what it is around here (gesticulates to the board) that would set the problem up as a particular type of problem ... I was hoping that by using colour on the board, I would be able to pull the ideas together and back to the string, but my string activity is getting derailed...

Coach: So given we wanted to introduce using strings and the time is running out...

Presenter: Then this isn't a good example to start with! (laughter) ... (to the class). Remember I said that we were learning as we went through and did this? I haven't done a string ever before, and I looked one up which was supposed to work.

Student: *Is the class context the issue? Is the problem that we are all student teachers and we've been told to look at every problem really flexibly and think of as many ways to solve a problem as we can?*

Coach: Yes, that might be the problem.

Presenter: Let's start again! (proceeds as a division problem and goes straight on to the 2<sup>nd</sup> question in the string: 20 litres, this time being put in 2 litre containers, how many containers are needed?, then 1 litre containers, then ½ litre containers ..., the rehearsal progresses smoothly).

A further aspect of *ako* is teachers being committed to holding and demonstrating high expectations of student learning. Many examples illustrating this aspect of *ako* were present in the rehearsals, including examples discussed above in which STs were expected to engage with mathematical activities, and think about, share, listen to, and discuss mathematical ideas. High expectations were modelled by presenters and coaches expecting that STs would be able to relate newly learnt theory to practice and take part in pedagogical discussions as they participated in mathematical activities (mathematics that some found challenging).



Again, we believe that STs could have been enabled to notice practices consistent with *ako* through discussion initiated by teacher educators during or after the rehearsal. For example, in this case, STs could have been asked to reflect on and discuss how the presenter had conveyed high expectations of their learning, how they had shown they were also a learner, how they initiated opportunities for students to learn from one another, and to consider how humour had been present and had been reacted to during the rehearsal. They could be led to discuss how they could incorporate such practices in their own mathematics teaching. Such discussion could also be used to consider aspects of *ako* not noticed in the rehearsals. For example, the instances from the rehearsals chosen above do not clearly demonstrate how a teacher may enable Māori students to achieve as Māori (Averill et al., 2014), or to explicitly demonstrate understanding that Māori learners' identity, experiences, and culture underpin their prior knowledge. We believe discussion could help STs identify and discuss how to address such gaps and that strategic use of planned modelled rehearsals could enable such practices to be exposed.

## Discussion

Our modelled rehearsals were useful for illustrating how student teachers' use of instructional activities would later be coached in rehearsals. In addition, they served to foster a shared sense of endeavour through the development of communities of practice focussed on the discussion of ambitious mathematics teaching practices. The excerpts above show how coaching within modelling has potential, through participation in both the instructional activity itself and in the deconstruction of the representation of practice, to provide opportunities to sensitise STs to culturally responsive teaching practices. However, establishing that opportunities exist for noticing is just a first step. To enable noticing and discussions of these practices, we recommend teaching STs about the practices, through providing specific information and explanation to enable them to recognise and critically discuss these aspects in the rehearsals. We are currently exploring how best to use such opportunities with in-the-moment coaching of teacher educator modelling and ST enactments.

Our assumption that to notice and discuss culturally responsive practices is a step towards STs' own use of these is drawn from the literature on professional noticing. However, as little specific evidence exists regarding links between enabling ST noticing of culturally responsive practices and their implementation in their own practice, examining such transfer is important to explore. Furthermore, to move beyond the application of generic aspects of the *wānanga* and *ako* competencies as demonstrated in this article, exploring how *wānanga* and *ako* can play out specifically in relation to Māori learners, the students for whom they are intended, is vital. Further exploration is also needed in relation to aspects of the cultural competencies focussed on engagement with *whānau*, *hapu*, and *iwi*, and how rehearsals can more strongly represent all five cultural competencies in ways consistent with their deep culturally-embedded meanings.

The modelled rehearsals required STs to co-perform a range of roles (mathematics learner, student teacher, and pausing the rehearsal to ask questions and make suggestions), at times proving challenging to navigate:

Student: *Is the activity helping us as learner teachers or is it for us to use with students?*  
Coach: Both. In the activity you are working as learners, in the pauses you are thinking as student teachers.



They also required the teacher educators to be thinking at multiple levels: modelling practice; creating the potential for discussion of practice – at times strategically modifying their teaching to do so; and asking and responding to questions about practice. In our experience, managing these ST and teacher educator roles places high demands on cognitive load, with the sessions intense and focussed. We found that elements of humour and laughter were present in all of the modelled rehearsals. On reflection, we believe that humour, prevalent and important in Māori culture (Derby, 2013), helped to maintain engagement and stamina during the modelled rehearsals through reducing their intensity, and helped STs feel comfortable about their own enactment of instructional activities being coached in later sessions.

Further exploration would be helpful to understand how to prioritise the many aspects of pedagogical practice that are valuable for student teachers to notice, reflect on, and discuss within coached representations and enactments of practice. Investigation could also help identify whether modelled rehearsals or coaching of student teachers' enactment of teaching is most valuable for developing the practice of those who are and who are not presenting. One consideration regarding coaching of teacher educator modelling is that two teacher educators are needed for each session. Worthy of further investigation is the effectiveness of experienced teachers or experienced student teachers taking the place of one teacher educator, teacher educators 'coaching' themselves, and the transferability of findings to professional development contexts.

## Conclusion

This work adds to the literature within teacher education on coaching, teacher educator modelling, professional noticing and discussion of mathematical pedagogical practice, and implementation of culturally responsive practice and policy in several ways. Firstly, our results indicate that modelled rehearsals (i.e., coaching of teacher educator modelling) can enable student teachers to participate in, notice, reflect on, and discuss pedagogical practice in relation to culturally responsive teaching strategies. Given the challenges in national and international contexts to adopting ambitious mathematics teaching practices that support culturally responsive teaching, this study provides promising results in relation to this new focus in the coaching of student teachers.

Secondly, we have provided further illustrations of how coaching pauses within representations of practice (modelling sessions) can provide opportunities for decomposition of practice, for student teachers to make the important links between theory and practice in a timely manner, as the instructional activity is being taught. Such opportunities are less easily managed in representations unaccompanied by coaching.

Thirdly, the examples and discussion provided here help to show how two cultural competencies, wānanga and ako, can be enacted within mathematics teaching and learning. Such curriculum-specific examples are essential for the promotion and adoption of culturally responsive practice as much theory and policy are stated generically across subject areas. Further development is required to ensure the focus on using the competencies to maximise learning of Māori learners is needed, but understanding the teaching implications themselves is an important first step towards this. The concurrent development of student teachers' understandings of Māori cultural knowledge and understandings is essential towards full implementation of the cultural competencies for teachers of Māori learners.

Implications of this research include that modelled rehearsals have potential to promote student teachers' capabilities to use culturally responsive practices through their participation in mathematical activities and through pedagogical discussions that are consistent with culturally responsive practices. Returning to our opening proverb, our findings help show that teacher educator modelling with in-the-moment coaching can be useful for assisting student teachers to notice, discuss, understand, and adopt the fine craftwork involved in using ambitious and culturally responsive mathematics teaching practices.

## Acknowledgements

This work was supported by the Teaching and Learning Research Initiative fund administered by the New Zealand Council of Educational Research. It is grounded in the collective work of the *Learning the Work of Ambitious Mathematics Teaching* project, led by Glenda Anthony and Roberta Hunter and whose members are Jodie Hunter, Peter Rawlins, Roger Harvey, Tim Burgess, and the authors. We are grateful to these colleagues for our partnership and ongoing discussions and learning over the length of this study. Particular thanks go to Roger Harvey for his collaboration in the teaching and data gathering that have contributed to this article.

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<sup>i</sup> Traditionally said as a compliment for craftwork such as a carving or weaving (Mead & Grove, 2001)

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